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PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND
EVAPOTRANSPIRATION CONDITIONS

78-10101

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for Period December 1, 1977 to March 1, 1978

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16. Abstract Scale rectification and registration procedures have been developed using NOAA-5 VHRR thermal data. A computer program for preparing surface temperature profiles from satellite data has been evolved. Arrangements have been made with the Soil Conservation Service to revise and consolidate to one-map-scale the soils information for the HCMM test site which comprises the four southmost Texas counties. Data handling methods are being developed for examination of the relationships between air temperatures and surface temperatures. Tentative selections have been made of 32 agricultural fields and rangeland locations for HCMM vegetative stress studies. Twenty homogeneous areas of approximately 30 km ² each are being investigated for synoptic applications of HCMM. Daytime and nighttime thermal aircraft data clearly show physical features such as ponds, lakes, rivers, irrigation canals, and drainage ditches. Variations of surface temperature within fields due to crop water stress, cotton root rot, high water table, and other causes are apparent.			
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TYPE II QUARTERLY PROGRESS REPORT

December 1, 1977 - March 1, 1978

A. Problems:

None.

B. Accomplishments:1. Data Handling Procedures Completeda. Scale-rectification and registration of satellite data to a base map.

Data handling techniques to be used with HCM data at Weslaco have been developed using NOAA-5 VHRR thermal data. A program has been developed to scale rectify and register the thermal data to a base map.

b. Surface temperature transects inland from the coast .

A computer program has been developed to prepare surface temperature profiles along 16 parallel transects extending from the coast to more than 200 km inland. NOAA-5 satellite data were used in preparing and checking out the program. See Fig. 1 for example of one temperature profile. The dashed reference line shows the alignment of the transect across four south Texas counties. Deviation of the temperature profile (solid line) from the reference (dashed line) is an indication of changing surface temperature, resolution element by resolution element. The data illustrated were obtained one night when freezing temperatures threatened the area; the reference temperature used was 0°C. One can see that the Gulf of Mexico is at about 22°C, that the temperature fluctuates around 0°C across Hidalgo County (2nd county from the coast), and that surface temperatures are decidedly below 0°C in Starr County (third county from the coast). The higher temperature of the water bodies was used to gray map them.

2. Procedures in Progress

a. Storing soils map in computer .

It is expected that HCMM data will be influenced by soil properties. In order to evaluate or correlate thermal data with respect to soils, arrangements have been made with the Soil Conservation Service to revise and consolidate to one map scale the soils information for the HCMM test site which comprises the four southmost Texas counties. Plans are to put this information, consisting of 34 soil associations, into the computer for retrieval while processing HCMM data.

b. Air temperature and surface temperature relationships .

A defined relationship between surface temperature and air temperature will permit the use of thermal satellite data in interpolating air temperatures between weather station locations. On the other hand, deviations from an air temperature vs surface temperature relationship may provide a good measure of aridity. A computer program for these types of investigations is being developed using NOAA-5 data sources. Several surface temperature representations will be tried including cells of 1x1, 3x3, 5x5, 7x7, and 9x9 satellite resolution elements.

c. Selection of individual crop fields .

Candidate individual fields (or contiguous fields) of the same crop are being located using (1) the 15 Dec 77 high altitude HCMM support aircraft flight, (2) listings of fields from previous ground truth that are ≥ 60 acres in size, (3) photo-mosaics of Hidalgo, Cameron, and Willacy Counties (1:90,000 scale), and (4) Landsat color composite transparencies and print enlargements.

Thirty-two agricultural fields and rangeland locations have been tentatively selected for HCMM crop stress studies. The crops being considered are citrus, cotton, sugarcane, and grain sorghum. Final selection of cotton and grain sorghum fields will be made after the candidate fields have been ground-truthed for crops planted this growing season.

Twenty homogeneous areas of approximately 30 km² each are being investigated as potential areas for study of synoptic or gross effects.

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C. Significant Results:

None.

D. Publications:

None.

E. Recommendations:

Readiness to start processing HCMM digital tapes as soon as they start arriving would be greatly aided if a dummy tape, in the same format as the real tapes, were provided to investigators. They could then develop processing algorithms and be ready to routinely handle the real tapes by launch time.

Likewise, investigators need information on the calibration of the sensors. For example, what coefficients used with the HCMM reflective infrared data will bring them into agreement with the data from Landsat-C?

Provide each investigator with a copy of S-250-P-1C, the NASA Reports guide.

F. Funds Expended:

Allotment for FY 78 _____ 45,240.

Location and 1 PSC Costs \$10,604.00

Other costs through 2/28/78:

Salaries	4,724.00
Travel & Transportation	426.00
Services & Supplies	0.00
Equipment	0.00

Total	\$15,754.00
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Balance	29,486.
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G. Data Utility:

The daytime and nighttime thermal aircraft data from 20 Jan 77 (nighttime), 26 July 77 (daytime), and 15 December 77 (daytime) clearly show physical features such as ponds, lakes, rivers, irrigation canals, and drainage ditches. Thermal effects of cropping patterns are apparent although it is not possible to consistently distinguish between the various crops. Variations of surface temperature within fields due to crop water stress, cotton root rot, high water table, and other causes can be seen. Differences in rangeland temperatures related to plant height (shaded area effect) are of interest. Micrometeorological effects of windbreaks only one tree wide showed prominently in the thermal data.

Urban area line-printer thermal maps of the January nighttime flight were studied by the Planning Department, City of McAllen. To be useful in energy applications, data from less than the 26,000 feet altitude of this flight are required. Nonetheless, urban areas are warmer than the surrounding agricultural areas.

The 15 December 1977 high altitude photography is being used to locate candidate sites (fields or contiguous fields) for the plant water stress objective.

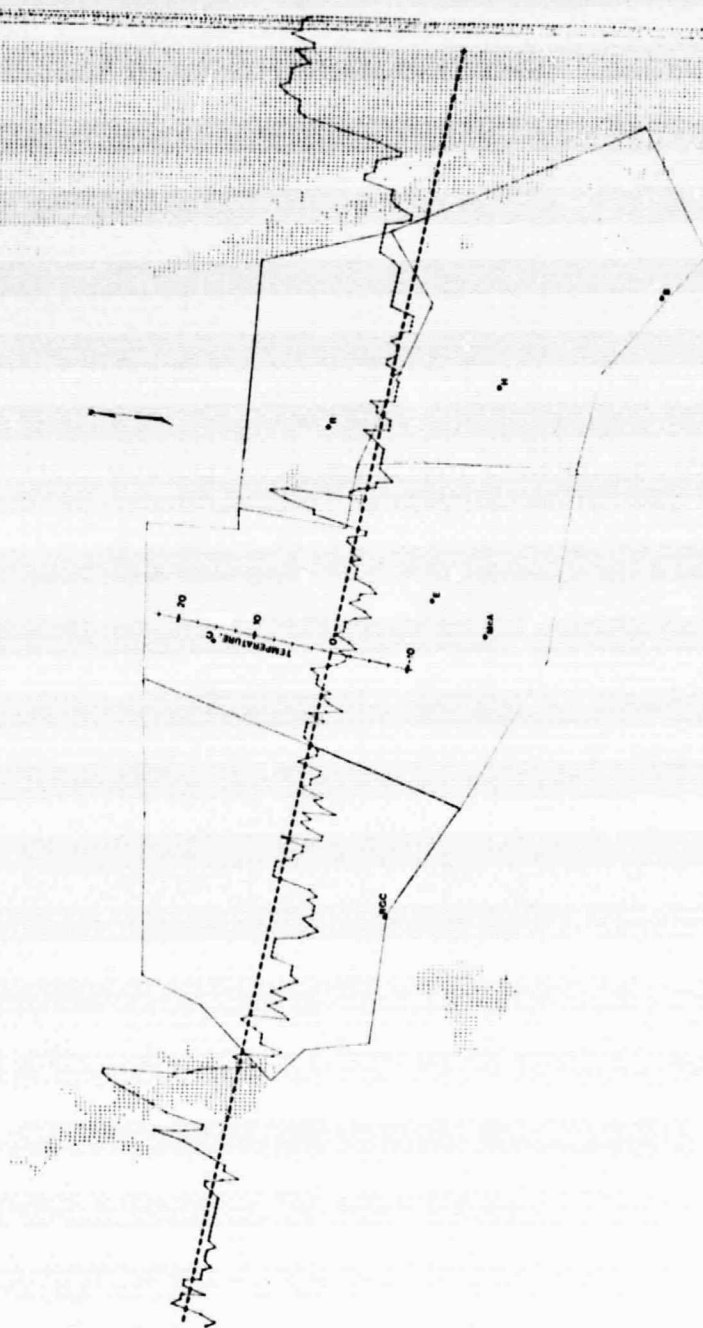


Figure 1. Example of a nighttime surface temperature profile extracted from satellite data. The dashed line serves both as representation of the transect alignment across the four southmost Texas counties and as reference (0°C) for the temperature profile (solid line).

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